Cryospheric Applications of Landsat-8

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National Snow and Ice Data Center, University of Colorado, Boulder Colorado

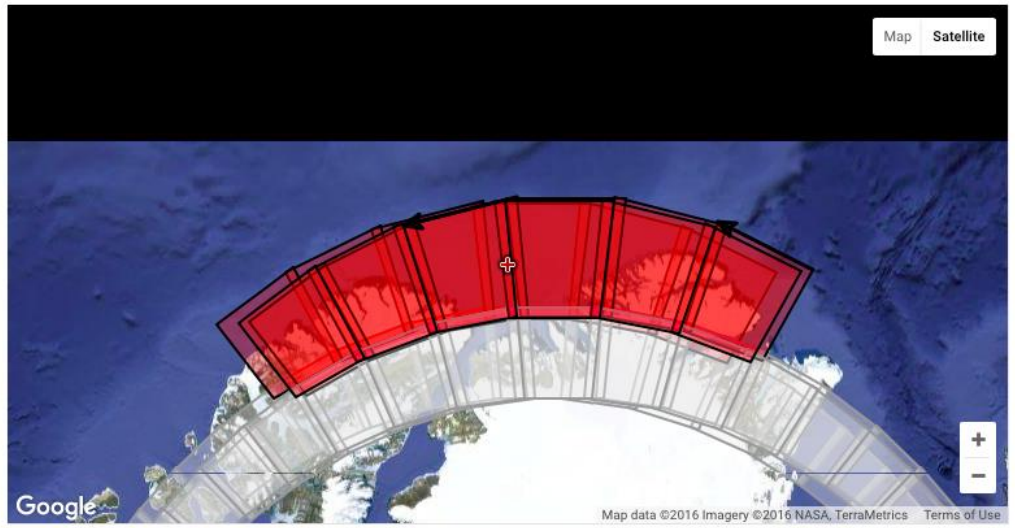
Greenland Off-nadir – northernmost land

Requester: Gene
Request category: Emergency
Name of request: arctic offender
Acquisition: Day
Start Date: 07/12/2016
End Date: 08/28/2016

Justification: Greenland and Ellesmere not imageable at nadir
Solar Angle Override: Yes
Number of Rows: 6
Point Entered: Latitude: 83.37601, Longitude: -56.67023

Review and Edit

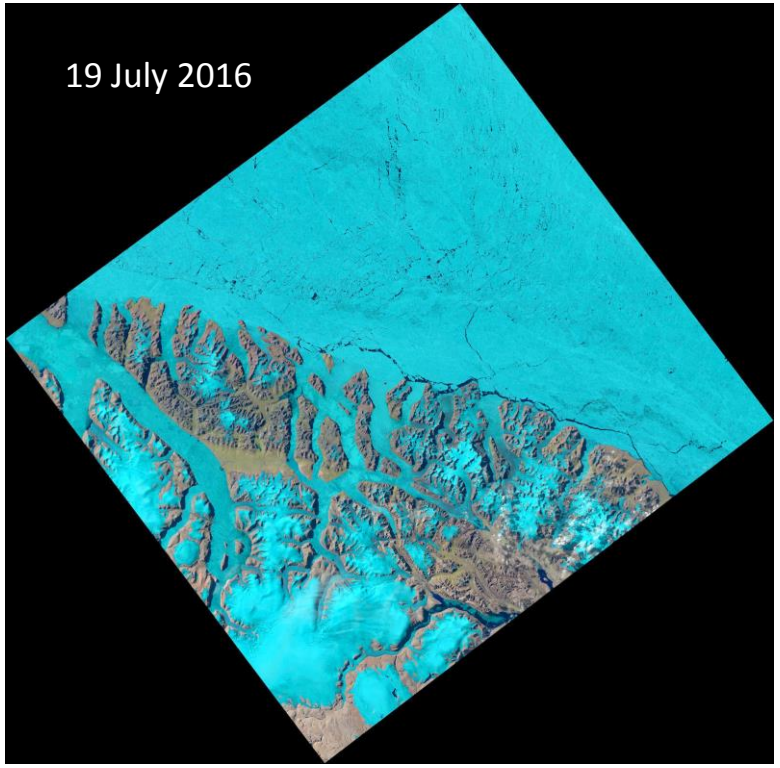
Show/Hide	Path/Row	Look Angle	Date	Select
Hide	37/244-53/1	Right 13.6	7/12/2016	◉
Show	53/242-247	Right 15.4	7/12/2016	○
Show	28/245-44/2	Right 16.9	7/13/2016	○
Show	44/243-248	Right 13.2	7/13/2016	○
Show	60/241-246	Right 19.0	7/13/2016	○
Show	35/244-51/1	Right 14.1	7/14/2016	○
Show	51/242-247	Right 14.6	7/14/2016	○
Show	26/245-42/2	Right 18.0	7/15/2016	○
Show	42/244-58/1	Right 13.1	7/15/2016	○
Show	58/242-247	Right 17.8	7/15/2016	○
Show	33/245-49/2	Right 14.7	7/16/2016	○
Show	49/243-248	Right 14.0	7/16/2016	○
Show	24/246-40/3	Right 19.2	7/17/2016	○
Hide	40/244-56/1	Right 13.2	7/17/2016	○
Show	56/242-247	Right 16.8	7/17/2016	○
Show	31/245-47/2	Right 15.5	7/18/2016	○
Show	47/243-248	Right 13.6	7/18/2016	○
Hide	38/244-54/1	Right 13.5	7/19/2016	○

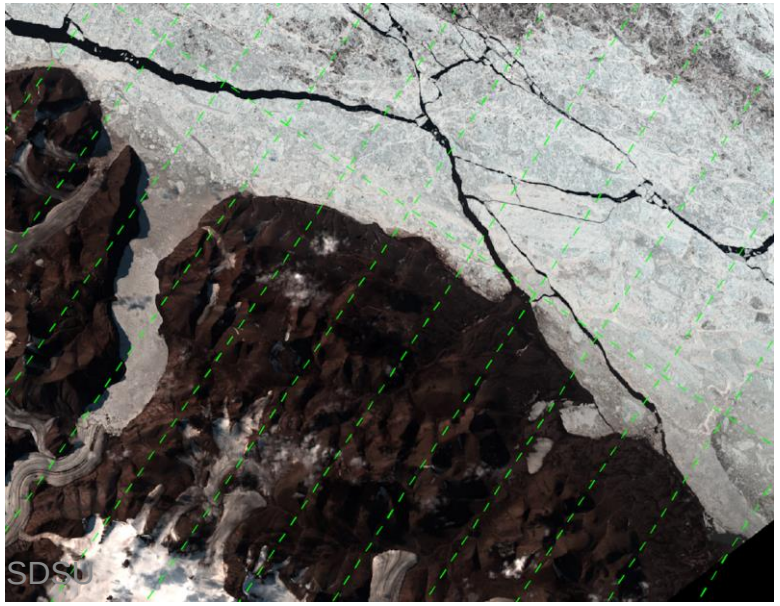


Scenes excluded due to Off Nadir Roll

References to non-U.S. Department of the Interior (DOI) products do not constitute an endorsement by the DOI. By viewing the Google Maps API on this web site the user agrees to these TERMS of Service set forth by Google.

<- Cancel Request and Start Over | <- Change this Request | Next ->





Global ice flow speeds --- image pair feature tracking

Python-based software (PyCorr) takes two sequential L8 OLI Band 8 scenes and matches small sub-scenes of the images

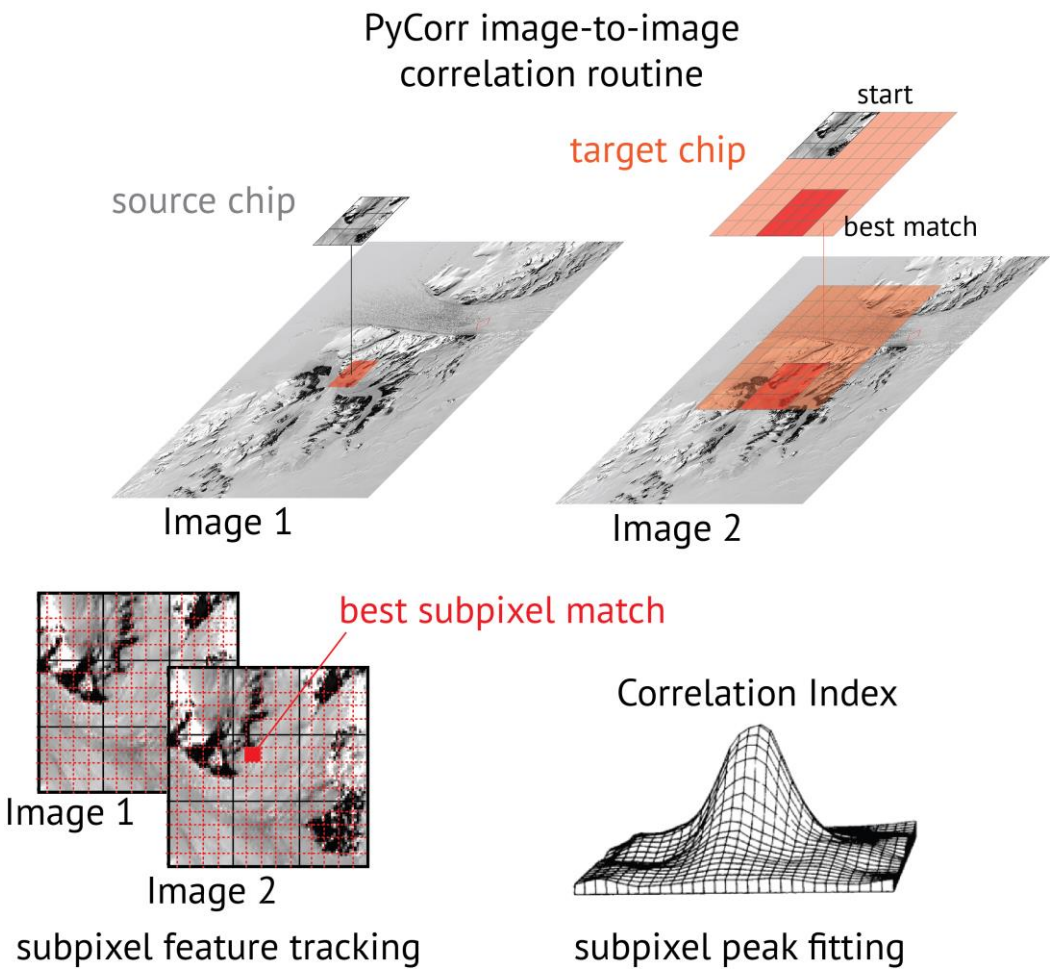
-- image correlation algorithm;
-- peak fitting in max correlation;
-- sub-pixel fits of offset vector.

New code makes use of higher radiometric fidelity of L8 and high precision of L8 scene geolocation;

Image pair resolves ice motion to ~0.3 pixels displacement; geolocation ~4m.

Image-to-image cross-correlation applied to ice motion –
Bindschadler and Scambos, 1991;
Scambos et al., 1992;
Fahnestock et al. 1993

Software name: **PyCorr** –
Python Image Correlation Engine.



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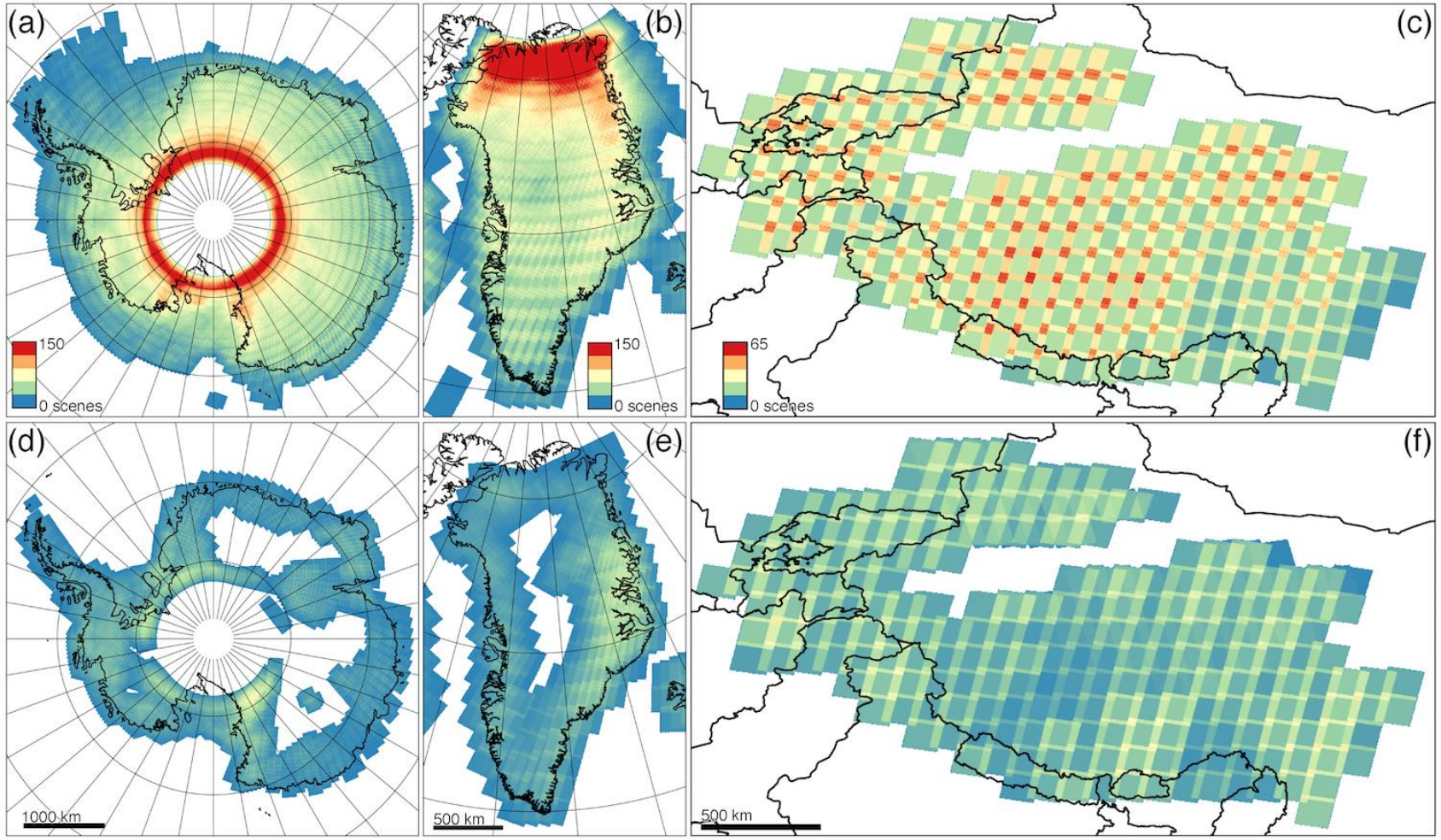


Current map of ice speed for Antarctica

Landsat Ice Speed of Antarctica (LISA);

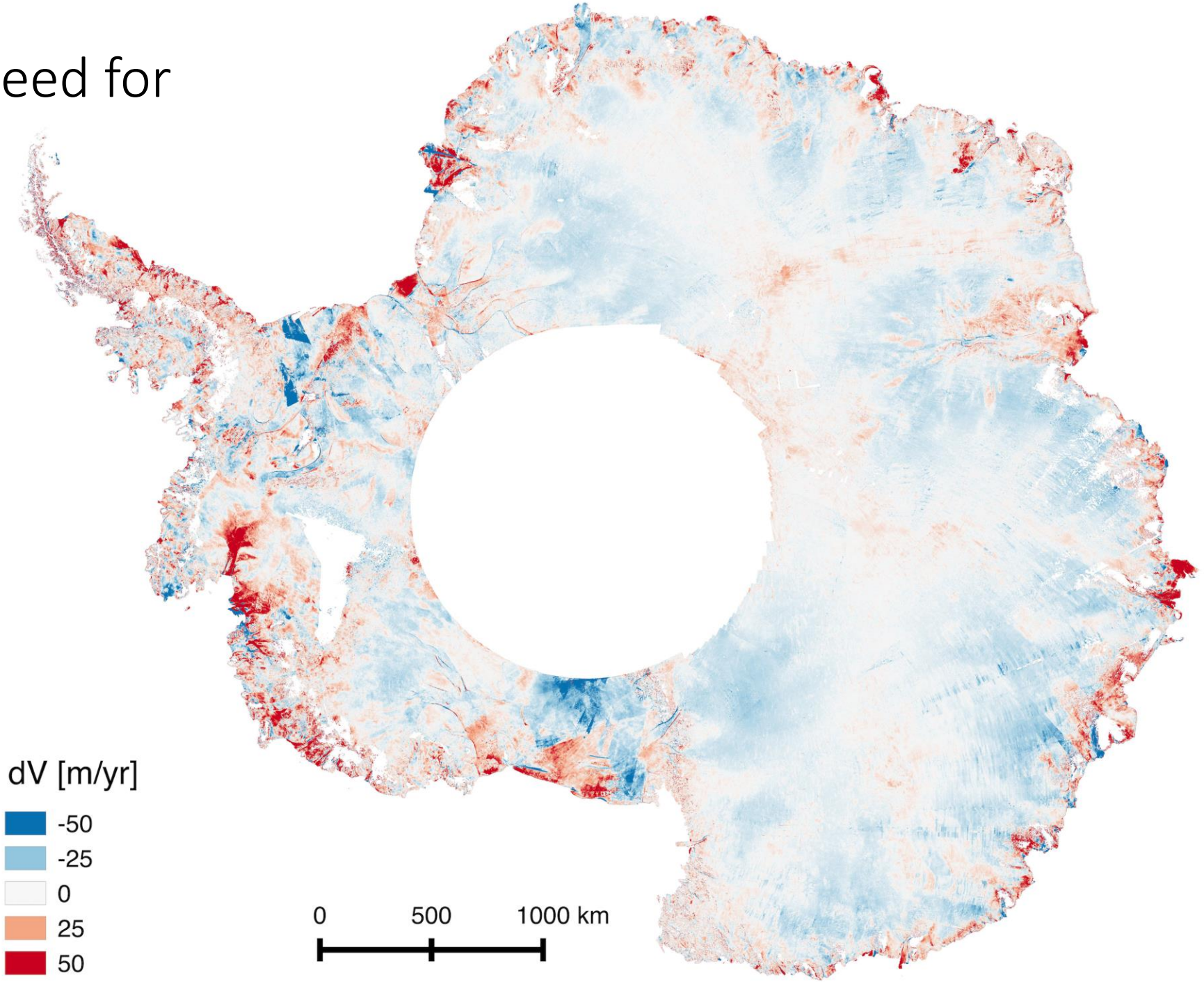
200,000+ ice **velocity** pairs

Oct 2013 – March 2015

~250 m resolution

Working toward continent-wide ice flux determination and estimate of ice mass budget;

Similar mappings in hand for Alaska, Greenland.



New project – **Global** Landsat Ice Velocity: **GO_LIVE**

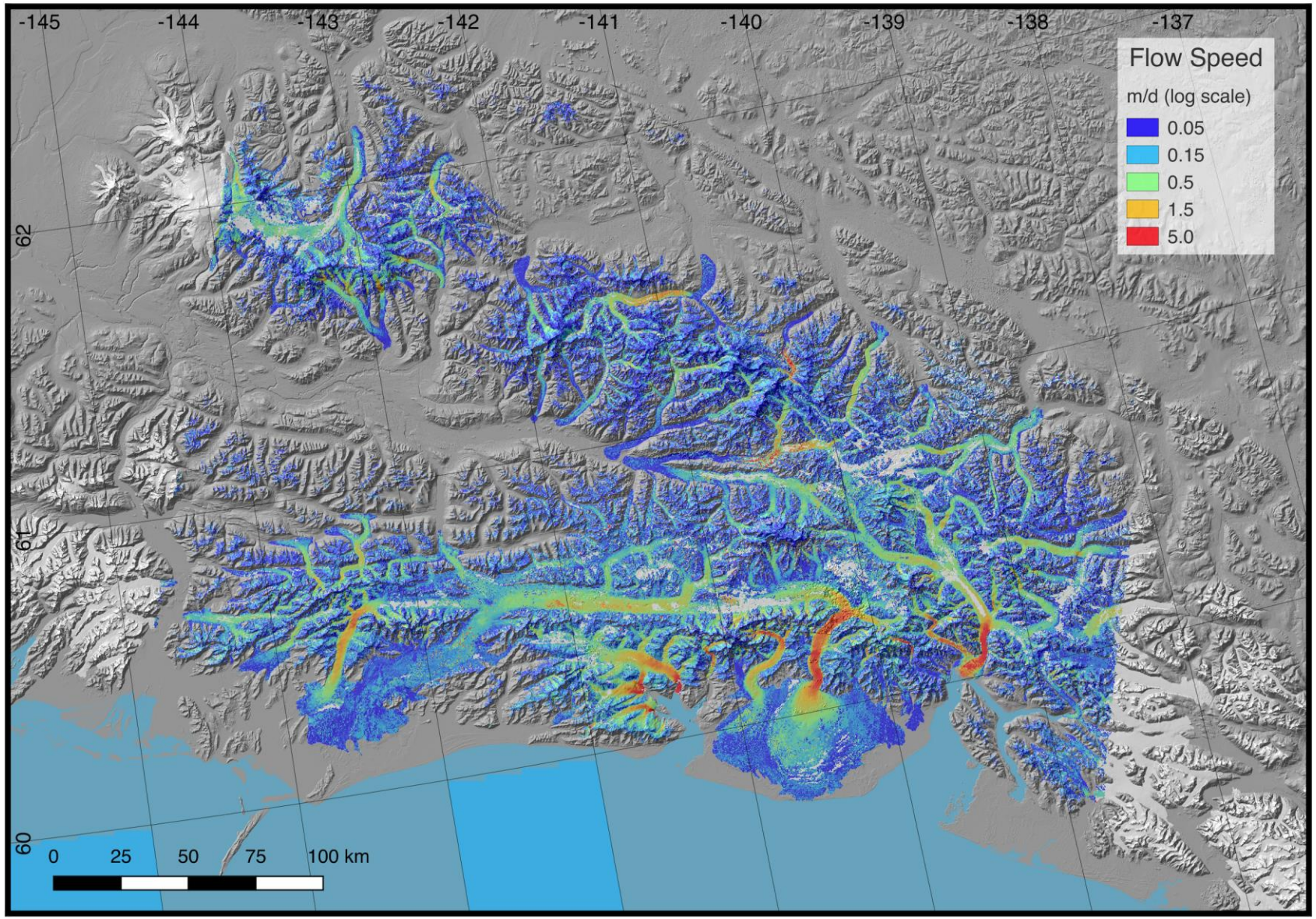
PyCorr now running on Univ. Colorado's multi-node supercomputer;

30,000 pairs per hour processing;

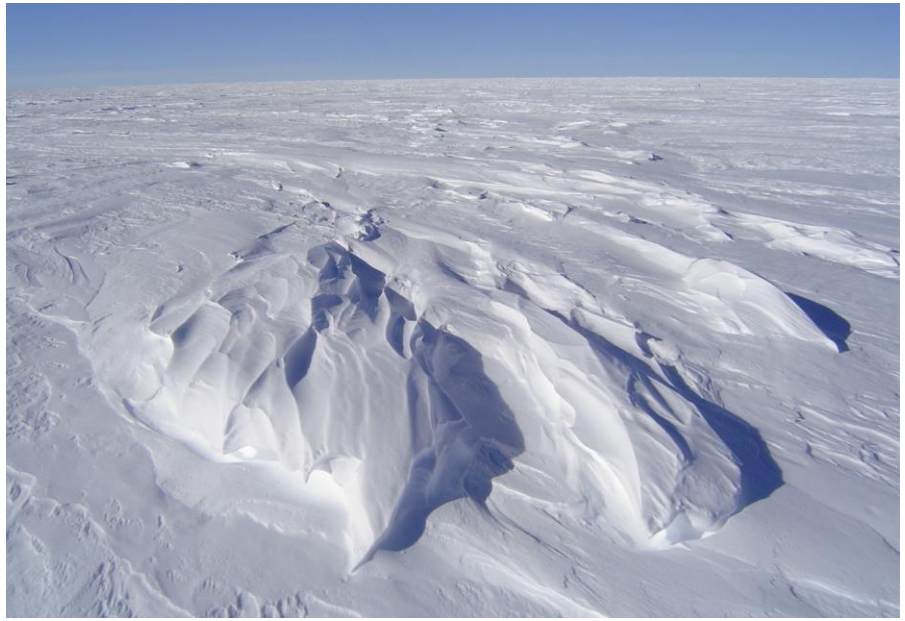
We will establish a processing stream that will produce ice velocities with a latency of about 1 week for global ice cover.

5 new mappings per new image

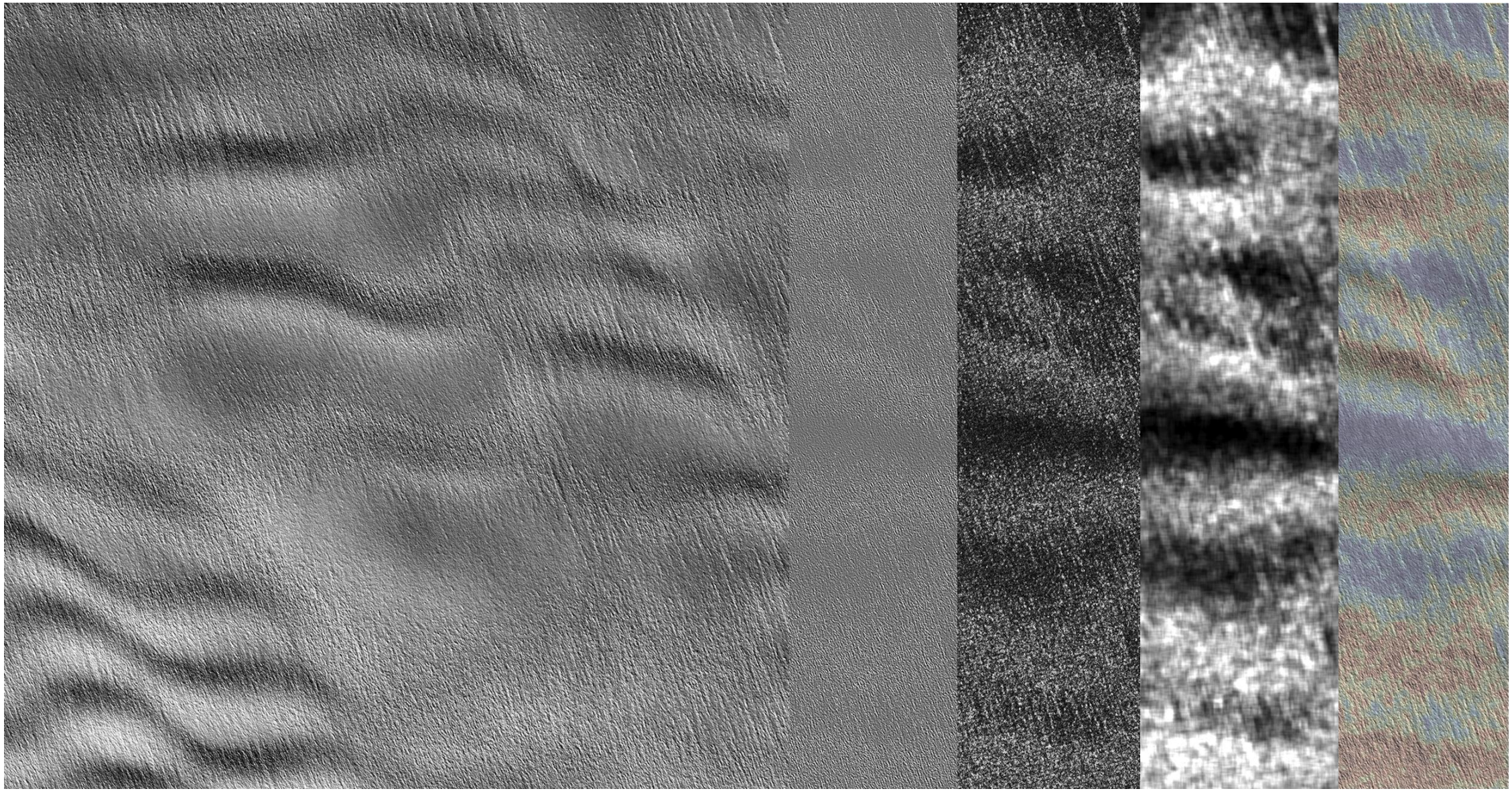
Distributed at the NSIDC data center



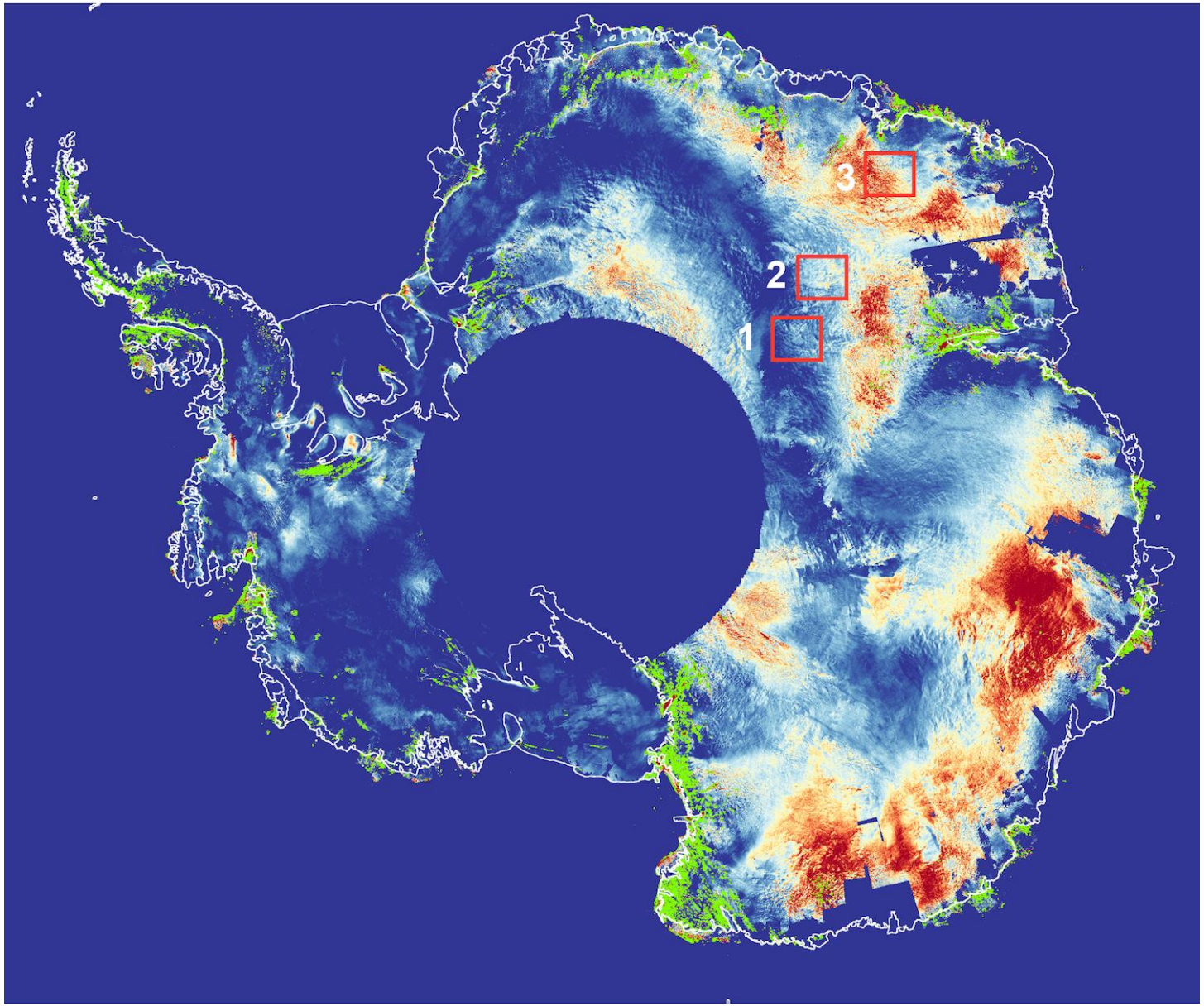
Surface Roughness Map of Antarctica from Landsat 8

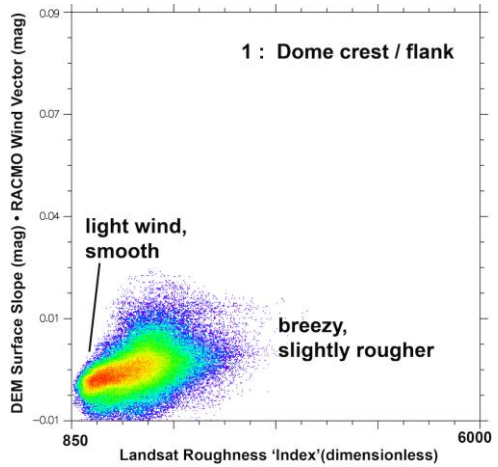


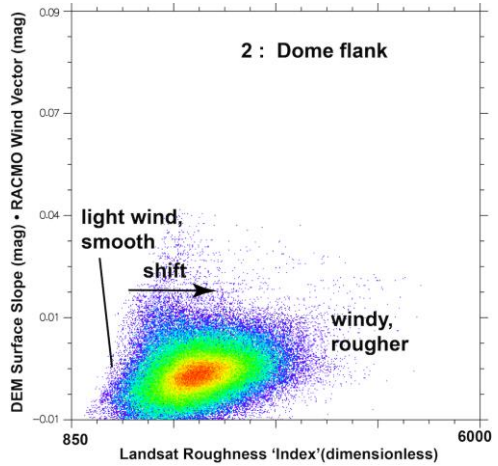
Surface Roughness Map of Antarctica from Landsat 8

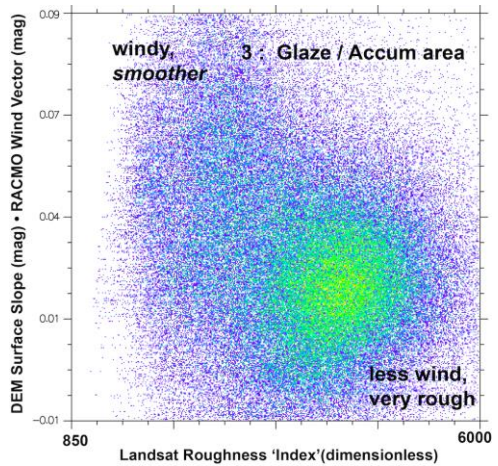


Surface Roughness Map of Antarctica from Landsat 8





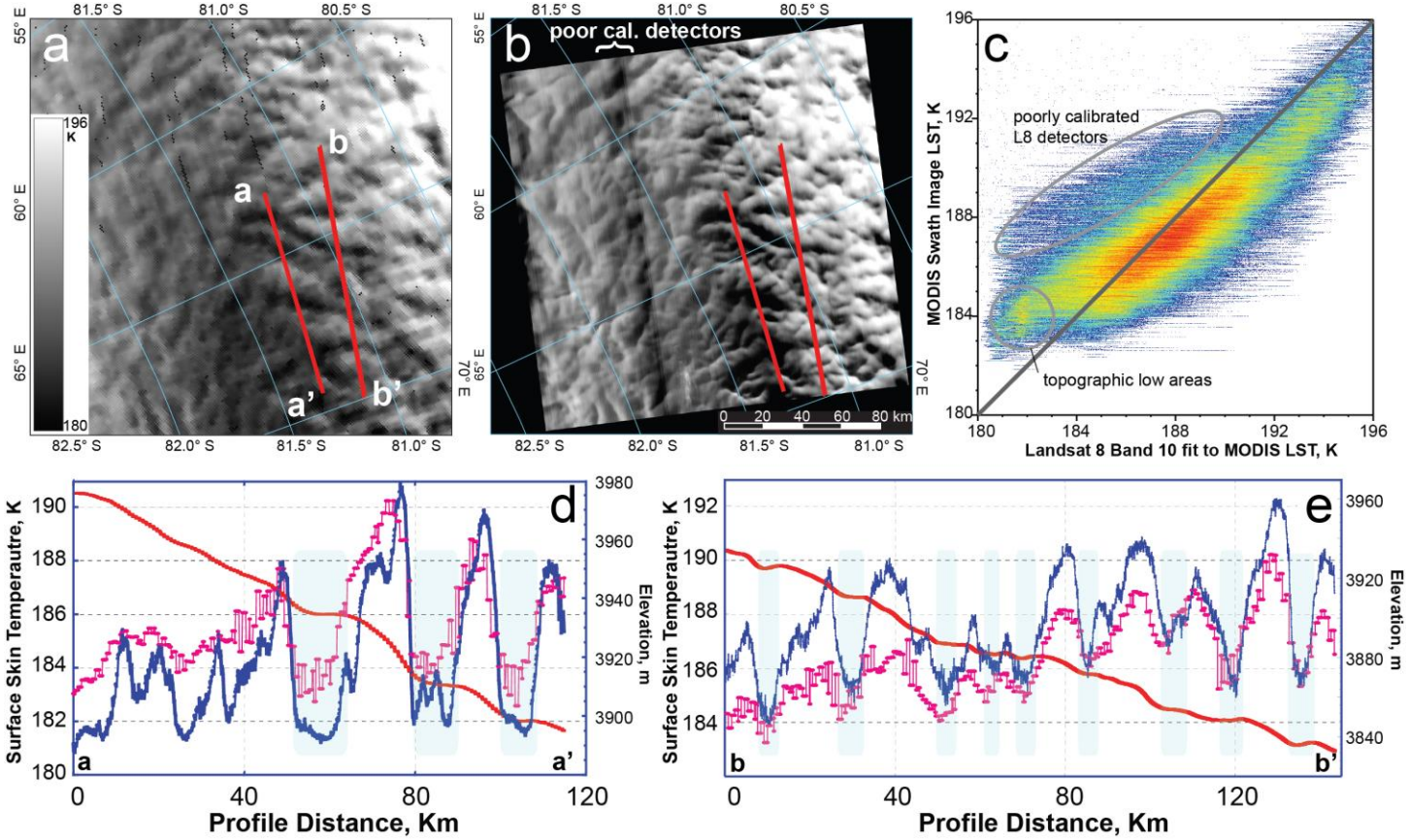


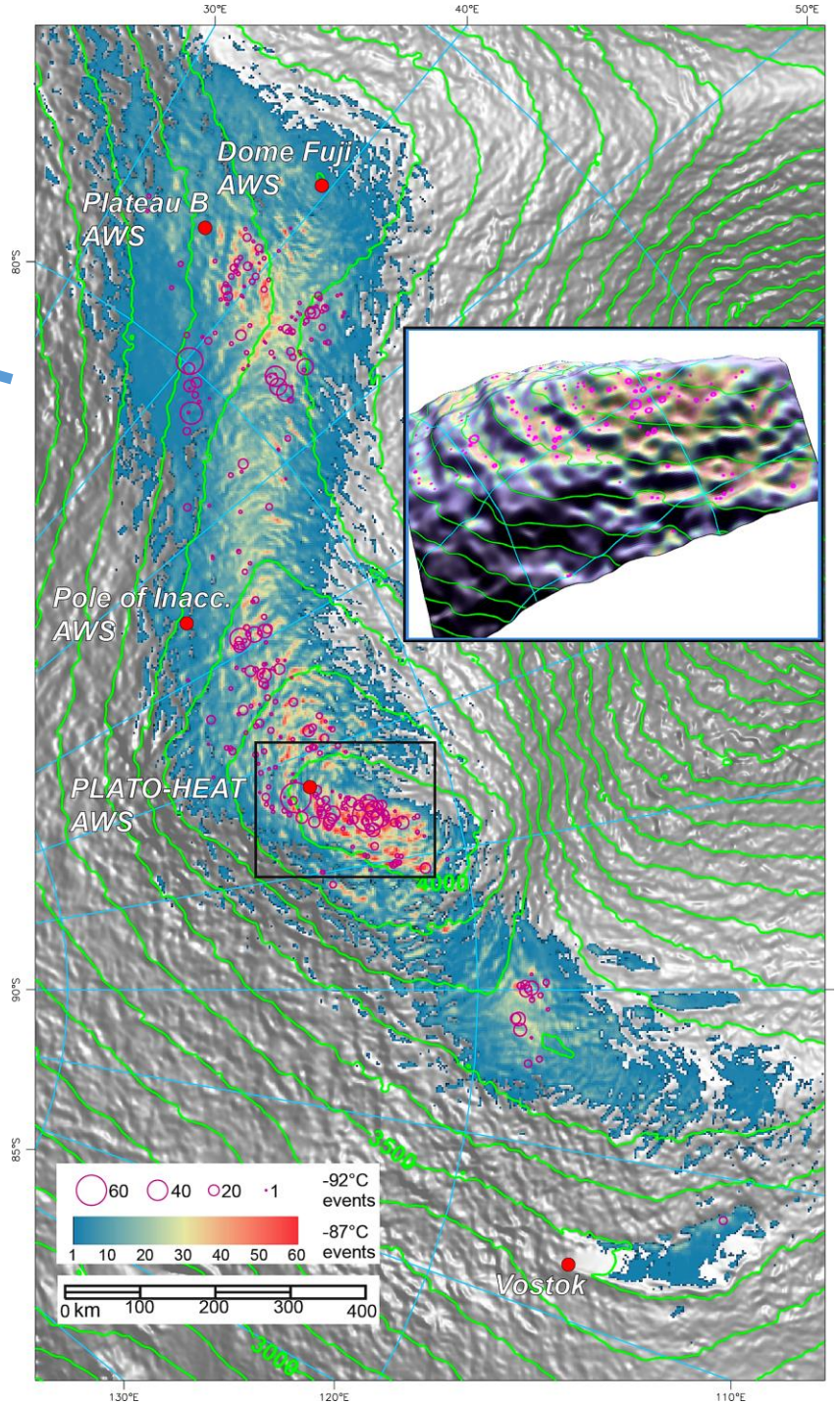


Ultra-cold winter temperatures in Antarctica

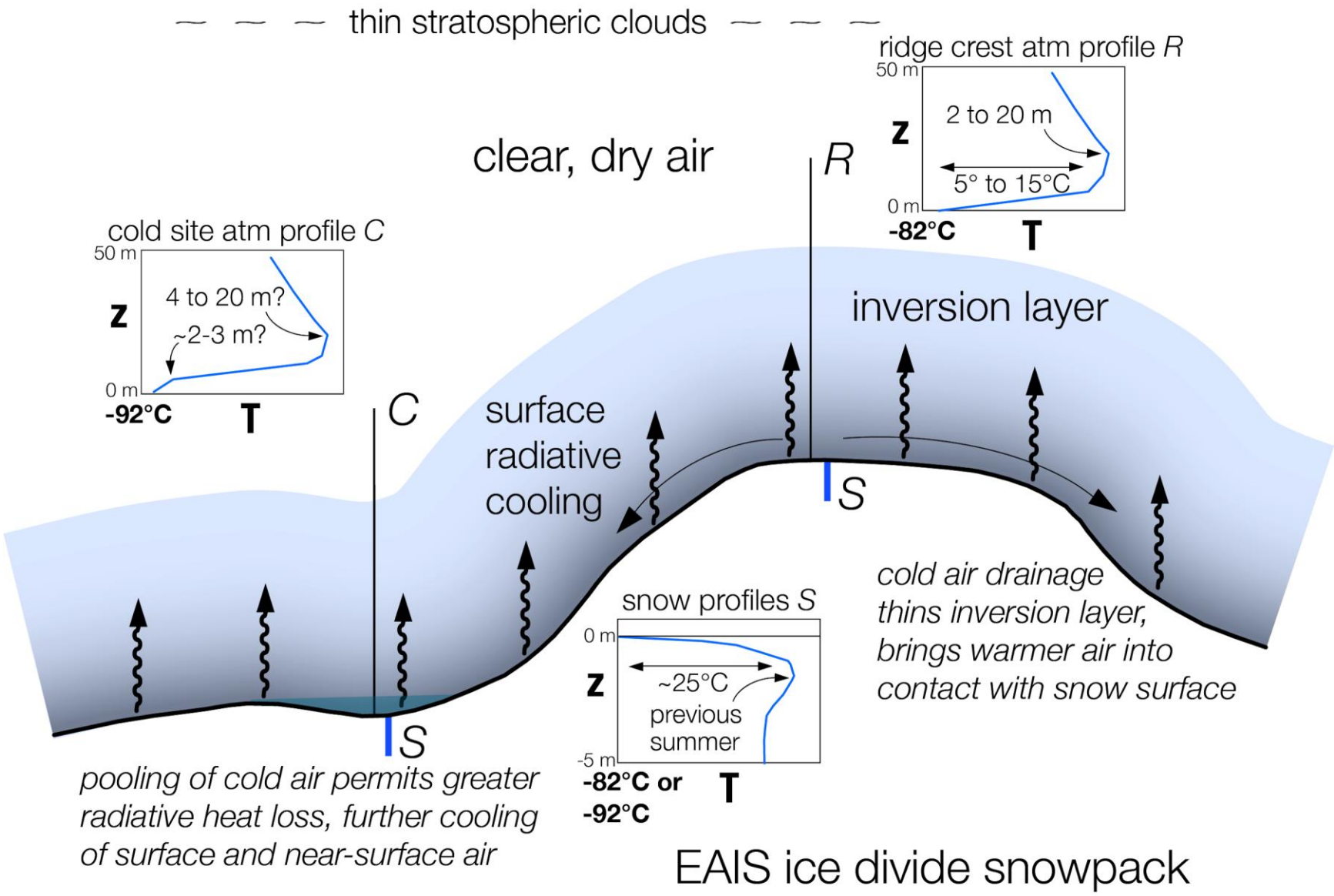
MODIS thermal emission
Low temperature events,
2002 – 2014

-87° C color bar (-124.6° F)
-92° C red circles (-133.6° F)





Ultra-cold winter temperatures in Antarctica - conceptual model



AGU 2016 session on Landsat 8 ice results

- ***C012: Cryospheric Applications of Landsat 8 and the Landsat Record***

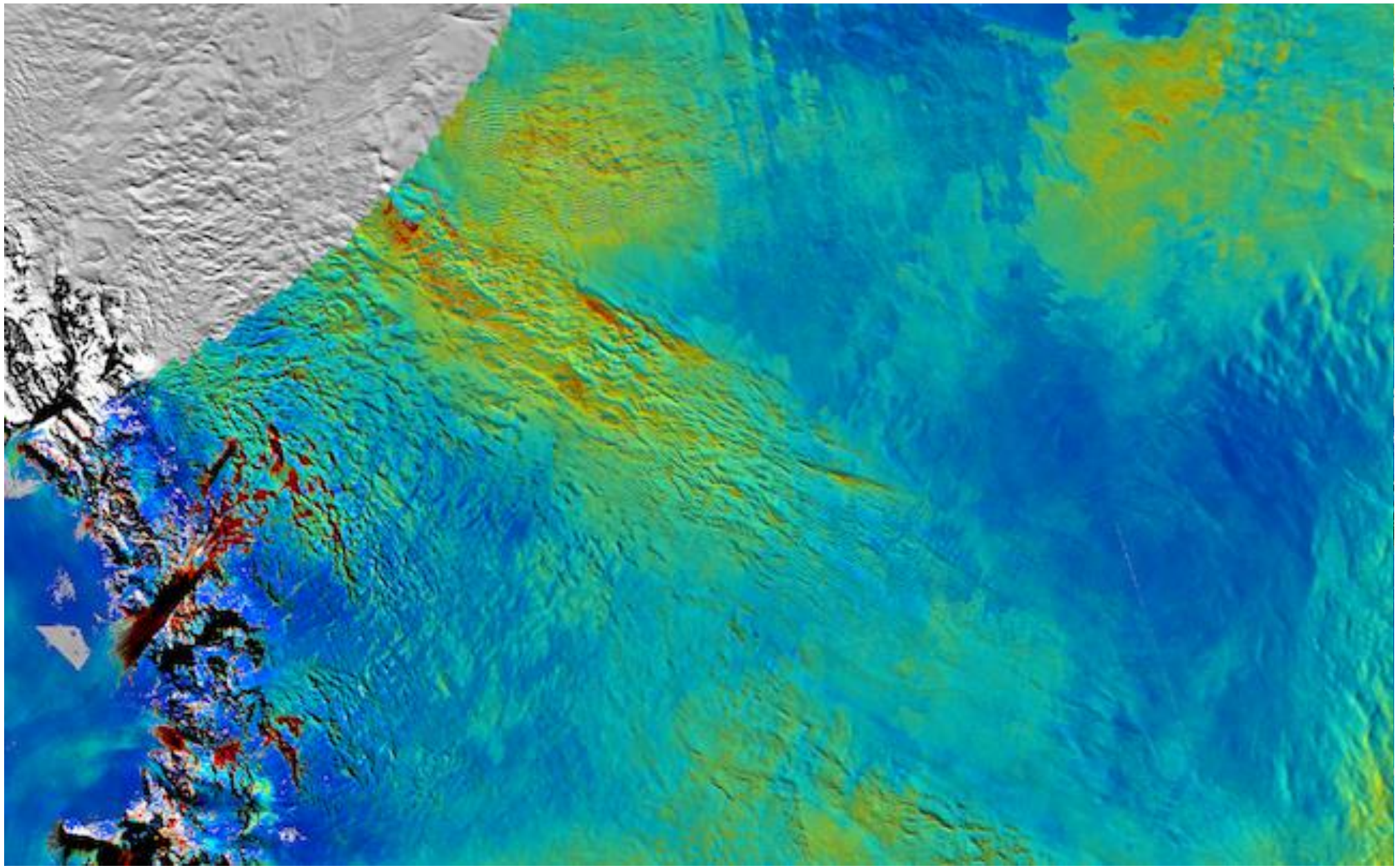
Launched in 2013 with a suite of improvements over its predecessors, Landsat 8 has sparked renewed interest in Earth observation using medium resolution imagery. In particular, high acquisition rates and 12-bit radiometry with a wider dynamic range are particularly helpful for cryospheric applications. In addition, Landsat 8 builds on an expanding and improved archive of Landsat imagery dating back to 1972. This long observational record also opens opportunities for studying environmental change. In this session, we aim to bring together contributions from a wide range of cryospheric disciplines (e.g., glaciers, ice sheets, sea ice, permafrost, seasonal snow, etc.) that highlight and discuss how Landsat 8 is moving forward our understanding of the Earth's frozen regions.

- **Conveners: ;Allen Pope, Mahsa Moussavi, Andreas Kaab, Ted Scambos;**

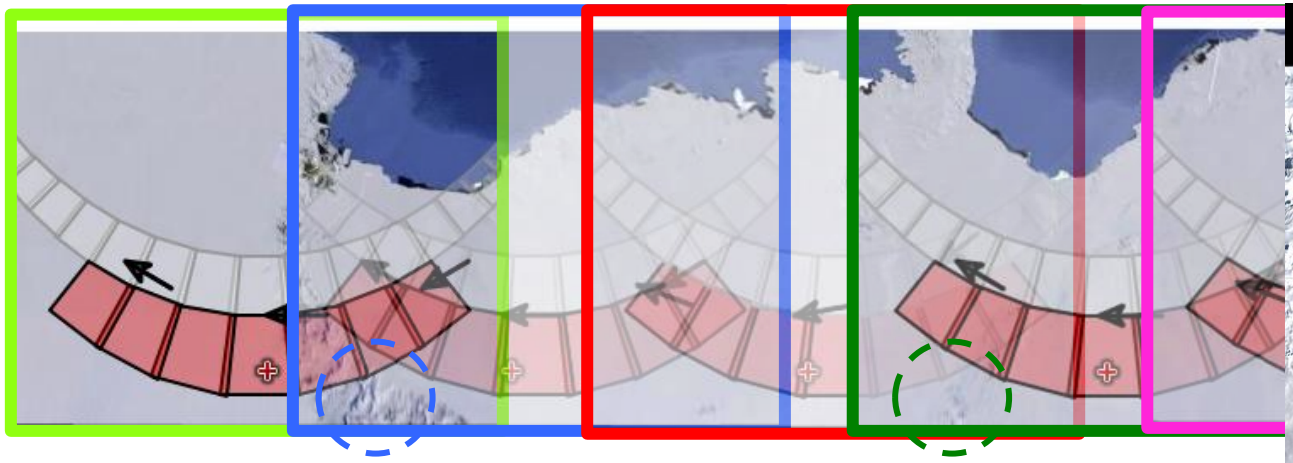
- **Invited speakers: Alex Gardner, JPL, Solveg Havstad, Univ. Oslo**


questions?

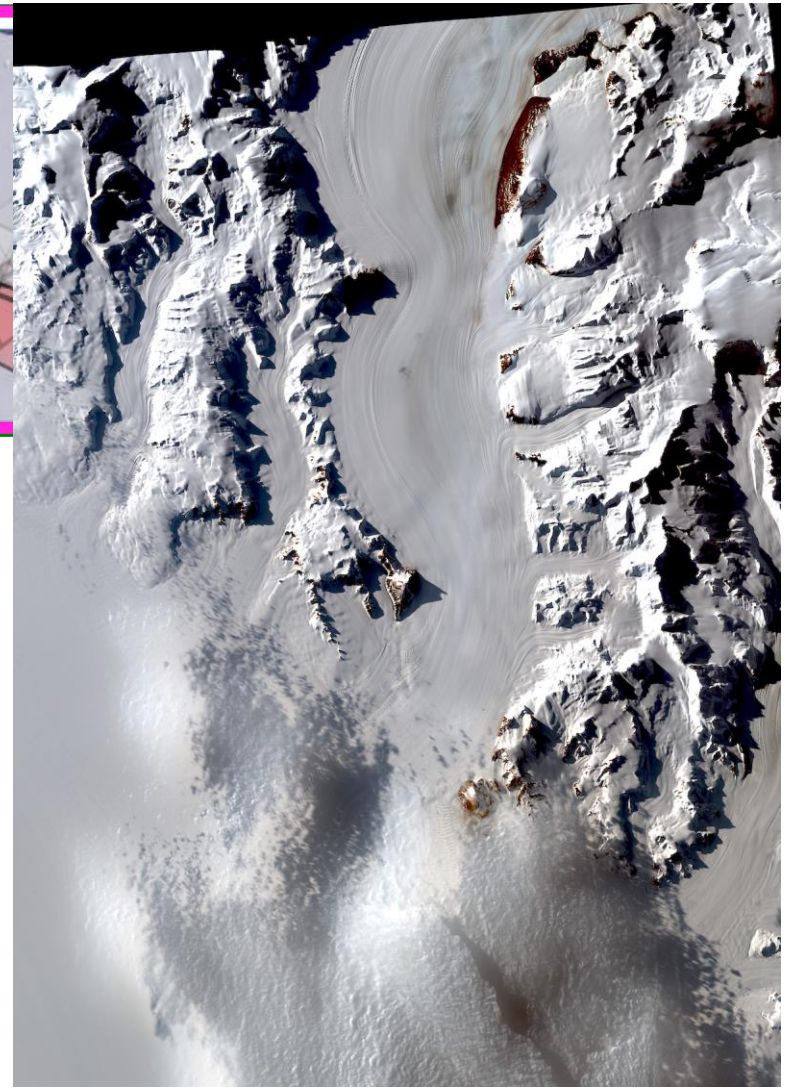
Surface Roughness Map of Antarctica from Landsat 8



Antarctic Off-nadir – Scott's path to the South Pole (and more)



Target Path	Target Lat	Target Long	7-scene Nadir	Look Angle	Cyc Day
231	-84	-156.14	228/119-225	L18.3	D11
191	-84	-94.34	187/119-125	L18.4	D12
151	-84	-32.53	151/119-125	L18.2	D16
111	-84	+29.26	112/119-125	L18.2	D15
71	-84	+91.06	73/119-125	L18.2	D13
31	-84	+152.86	28/119-125	L18.2	D2
13	-84	-179.32	17/119-125	L18.4	D5
169	-84	-60.35	163/120-126	L18.7	D4



Landsat 10 – Polar and ice–related perspectives

T. Scambos, A.Pope

— assuming a ~2030 launch

- 15-meter, multispectral imaging **can only be of value in this timeframe** if :
  --- radiometric resolution is exceptional (14-bit) and well calibrated
  --- acquisition frequency is very high (4 days), with **global land +sea ice coverage**
  --- Split-window thermal bands are included at 2x – 4x spatial resolution
  ---Geolocation should be <3 m globally.

- Key bands for snow and Ice are (prioritized): red, infrared, thermal, cirrus, green, swir 1.6µ;
  Keep bands and response curves as consistent as possible.

- Mission goals should emulate **MODIS** mission goals of the 2000-2010s.
  --- land ice changes, ice velocity mapping
  --- surface melting, albedo, reliable global surface reflectance product
  --- melt lakes on ice sheets, glaciers, sea ice, tundra
  --- snow cover, snow melt runoff, lake ice-on/ice-off;
  --- sea ice tracking, sea ice morphology